Weed Costs Per Day (2)

New Perspectives on Research into Early Weed Control

A Summary of Research Findings and Recommendations from

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White Papers on Weed Control is a series of research and agronomic reports to disseminate recent findings and their value for on-farm weed management.

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Weed Costs Per Day

New Research into the Yield and Economic Benefits of Timely Weed Control

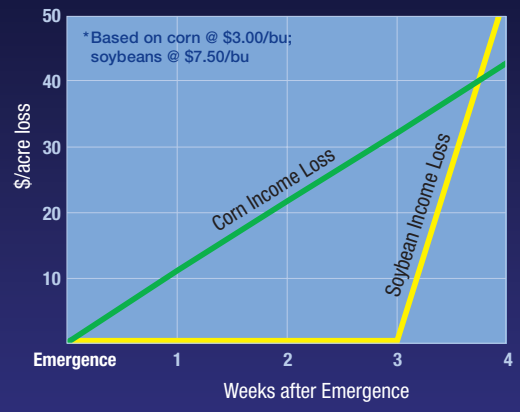
Two new concepts offer the potential for producers to manage their weed control programs to achieve higher yields with improved profitability.

The first concept is 'switch-point'. Our research demonstrates that corn and soybeans hold onto their full yield potential until they reach a specific point in their development. If weeds compete with the crop after this point, there will be a real, irreversible yield loss.

The second concept is 'weed costs per day'. After the switch-point, yield losses accumulate every day that weed control is delayed. Again, these weed costs are irreversible.

The Cost of Your Herbicide Application Timing

The Income Penalty from Late Weed Control*



Early weed control is essential for optimum corn yields. See graph, which summarizes our research across 20 trials with corn and 16 trials with soybeans.

Irreversible weed costs in corn begin almost as soon as the corn emerges. By three weeks after emergence, (when many growers may be into their post-emergent applications) these costs had already climbed to an average $31.50 per acre.

Field and environmental conditions influence both the onset and the speed of yield loss. See below. However, yield loss in corn begins much earlier than we had previously thought.

By contrast, while soybeans lost yield more rapidly than corn, they did not begin to lose yield until an average three weeks after emergence.

Benefits of early weed control in corn

- higher crop yields
- young weeds are easier to control
- options in difficult years

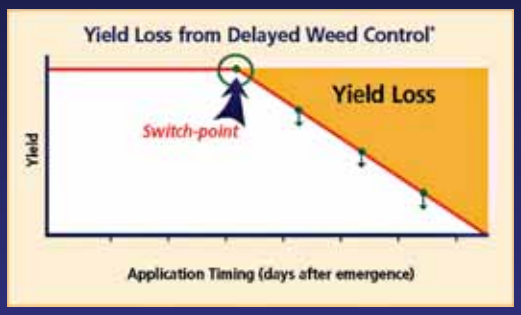
Over the past two decades, researchers at the University of Guelph and elsewhere documented a critical weed-free period in corn, from the 3rd to the 8th leaf stage of the crop. If weeds were not controlled during this period, yields were reduced by five per cent or more.

Our research has looked at the patterns of yield loss in individual fields to further refine this concept.

It is worth keeping in mind, however, that yield is only one of the benefits of early weed control in corn. Weeds are easier to control before they get large. As well, in the event that growers cannot apply their weed control early, they can switch to later post-emergence options. If the plan is to go mid or late post-emergence, and this plan is interrupted, then growers are left with only rescue options and the likelihood of significant yield loss.

Switch-Point for corn yield

- each crop in each field has a specific point when irreversible yield loss begins



'Switch-point' is a key discovery from our multi-year research. Switch-point also promises to provide a foundation for more profitable weed control.

We wanted to know if there were particular periods when corn was at high risk of yield loss, as well as periods when it was at low risk. Intuitively, we had thought that yield loss would begin slowly and then gradually worsen as weed competition increased. That, however, is not what we found.

Instead, corn retains its full genetic yield potential until it reaches a specific time in the growing season, generally about the 3rd leaf stage. After that point, called the switch-point, irreversible yield loss begins, and the losses begin to add up day upon day.

Thus, the recommendation for growers is:
Control your weeds before your switch-point.

Corn

Switch-Point Yield Impacts

Days after Switch-Point	Average Pressure		Competitive/Stressful	
	Yield loss (bu/acre)	$/acre	Yield loss (bu/acre)	$/acre
1	0.5	$ 1.50	1.0	$ 3.00
3	1.5	$ 4.50	3.0	$ 9.00
7	3.5	$10.50	7.0	$21.00
10	5.0	$15.00	10.0	$30.00
14	7.0	$21.00	14.0	$42.00

*Based on corn @ $3.00/bu

Based on our research, a one day delay in herbicide application after the switch-point in corn would result in a yield loss of 0.5 bushels per acre. If, because of weather conditions or workload constraints, the herbicide application was delayed by one week, this would result in a yield loss of 3.5 bushels per acre.

In more competitive or stressful environments, higher yield losses should be expected, with correspondingly greater impacts on per acre income. At one very competitive site, we recorded a yield loss of 3.2 bushels per acre per day. At sites with extremely low weed pressures, yield losses were less than half a bushel per day.

It can be difficult or impossible to accurately predict the rate of yield loss prior to the season. See below.

Soybeans

Switch-Point Yield Impacts

Days after Emergence	Days after Switch-Point	Yield Loss (bu/ac)	$/acre
21	0	0	0
22	0	0	0
23	1	1.0	$ 7.50
24	2	2.0	$15.00
25	3	3.0	$22.50

*Based on soybeans @ $7.50/bu

Soybeans reach their switch-point later than corn. In these trials, the switch-point didn't occur until an average 23 days after emergence, at approximately the 2nd trifoliate stage.

On average in these trials, growers would therefore have had three weeks after crop emergence before needing to have weeds controlled.

As in corn, yield losses prior to the switch-point were minimal. Upon reaching this date, however, the yield loss climbed to an average 1.0 bushels per day for every day that weed control was delayed from the 2nd to the 3rd trifoliate stage.

Also like corn, the timing of the soybean switch-point and the rate of yield loss varied with field and environmental conditions.

Switch-Point and Field Management

Each crop's switch-point varies with the field situation and the year.

To optimize switch-point weed control,

- **understand the role of switch-point in the growth of your crop**
- **know your weed species**
- **know your fields**
- **keep accurate records**

Fields are dynamic environments with complex relationships involving multiple biological, climatic, and physical factors.

Growers, however, can help predict how switch-point research may be best applied to their fields. As always, growers who keep keep accurate weed records and know their fields are in a better position to implement optimal weed management programs and maximize profitability.

Key points to incorporate in a weed control strategy are:

- the switch-point in corn tends to be much earlier than in soybeans, making early weed control in corn a higher priority
- in corn, the switch-point on average occurs about the 3rd leaf stage, but is variable based on field and weather conditions
- yield losses after the switch-point are irreversible

Assessing Field-by-Field Weed Control

Greater Yield Risk	Reduced Yield Risk
Broadleaf weeds	Low weed pressure
Weeds emerging close to time of crop emergence	Late weed emergence
Moisture and other stresses	Favourable growing conditions

Where yield risks are higher, the switch-point tends to occur earlier, and the rate of yield loss is more severe.

In general, broadleaf weeds are more competitive than grasses. Early germinating weeds also pose a greater yield threat than weeds which emerge later in the growing season. Fields which experience moisture stress (i.e. sandy soils, or compacted heavier soils) may be at greater risk to yield losses from weed competition.

Where yield risks are lower, the switch-point tends to occur later.

Grasses tend to be less competitive than broadleaf weeds. In addition, late germinating weeds are a lower threat to yield than weeds which emerge at or shortly after crop emergence. As well, yield risks tend to be lower in seasons with adequate moisture and in fields with low stress.

Weed Costs Per Day

Management opportunities to improve per-acre returns:

- **recognize that yield loss is irreversible**
- **learn that yield loss begins much earlier than we had thought**
- **understand that yield loss is additive with every day that weed control is delayed after the switch-point**

Our research suggests that corn and soybeans have switch-points, marking the onset of substantial yield losses due to weed competition.

Know your fields, keep good records and monitor your crops.

The switch-point tends to occur much earlier in corn than in soybeans, indicating that growers should emphasize early weed control in their corn management.

It is important to consider the economic benefits that arise from controlling weeds before yield losses occur. We believe this research will assist growers to implement weed management programs for optimal weed control and to maximize profit.

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